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PATENT APPLICATION

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INVENTION: LAMINATED COMPOSITION FOR A HEADLINER AND OTHER APPLICATIONS

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SPECIFICATION

To All Whom It May Concern:

Be it known that Garry E. Balthes, a citizen of Canada, residing at 26690 Pleasant Place, Elkhart, Indiana 46514, Darrel R. Eggers, a citizen of the United States of America, residing at 19996 US 20, Briston, Indiana 46507, and Harry R. Hickey, a citizen of the United States of America, residing at 47126 Grand Cypress Court, Macomb, Michigan 48044, have invented certain new and useful improvements in a

LAMINATED COMPOSITION FOR A HEADLINER
AND OTHER APPLICATIONS

of which the following is a specification.

LAMINATED COMPOSITION FOR A HEADLINER AND OTHER APPLICATIONS

RELATED APPLICATIONS

The present application is a Continuation-in-Part of U.S. Patent Application, Serial No. 10/287,250, filed on November 4, 2002, entitled *Process, Composition and Coating of Laminate Material*, which is related to and claims priority to U.S. Provisional Patent Applications: Serial No. 60/347,858, filed on November 7, 2001, entitled *Laminated Panels and Processes*; Serial No. 60/349,541, filed on January 18, 2002, entitled *Truss Panel*; Serial No. 60/358,857, filed on February 22, 2002, entitled *Compression Molded Visor*; Serial No. 60/359,017, filed on February 22, 2002, entitled *Assemblies and Tooling for Work Surfaces*; Serial No. 60/359,602, filed on February 26, 2002, entitled *Compression Molded Visor*, and Serial No. 60/400,173, filed on July 31, 2002, entitled *Composite Material*. To the extent not included below, the subject matter disclosed in those applications is hereby expressly incorporated into the present application.

TECHNICAL FIELD

The present disclosure relates generally to vehicle headliners, and more particularly to laminated panel and core compositions, illustratively for use therein.

BACKGROUND AND SUMMARY

Vehicle headliners are known in the art. Such headliners are typically used to provide sound absorption, padding, and aesthetics to the ceiling of a vehicle. Conventionally, vehicle headliners have sufficient impact absorption and sound absorption, as well as the ability to receive any variety of aesthetically pleasing

coverings. Because of the varied environments that vehicle headliners are exposed to, however, heat stability can also be a relevant factor to consider. Since vehicle headliners, for the most part, are located at the uppermost portion of a vehicle passenger compartment, any heat that is generated in that compartment would rise to that upper location and possibly affect the headliner. Consequently, vehicle headliners that are located in, or are subject to, prolonged elevated temperature environments should be dimensionally heat stable.

It would, thus, be desirable to provide a composition of material that has dimensional stability in high temperature environments.

Accordingly, an illustrative embodiment of a vehicle headliner panel is provided. The headliner comprises a core layer having first and second surfaces, and first and second permeability-resistance layers. The core layer comprises a binding resin, randomly-oriented sisal fibers, and randomly-oriented natural filler fibers. The first permeability-resistance layer is located on the first surface of the core, and the second permeability-resistance layer is located on the second surface of the core.

In the above and other illustrative embodiments, the headliner panel may also provide: the binding resin being polypropylene; the permeability-resistance layer being a film; the permeability-resistance layer being a polypropylene film; the natural filler fibers being selected from a group consisting of flax, jute, kenaf and hemp; the binding resin being present in an amount ranging from about 25 to about 35 weight percent; the sisal fibers being present in an amount ranging from about 35 to about 45 weight percent; the natural filler fibers being present in an amount ranging from about 25 to about 35 weight percent; the binding resin being present in an amount of about 30 weight percent, the sisal being present in an amount of about 40 weight percent, and the natural filler fibers being present in an amount of about 30 weight percent; and polypropylene comprising about 5 weight percent maleic anhydride and about 95 weight percent generic polypropylene.

Another illustrative embodiment provides a vehicle headliner which comprises a core layer, a permeability-resistance film layer, and a fiberglass layer. The core layer has first and second surfaces and comprises a binding resin, randomly-oriented sisal fibers, and randomly-oriented natural filler fibers. The permeability-resistance film layer is located on the first surface of the core. The fiberglass layer is located on the permeability-resistance film layer opposite the core layer.

In the above and other illustrative embodiments, the headliner panel may also provide: a film layer being located over the fiberglass layer, and a second fiberglass layer being located on the permeability-resistance film layer opposite the fiberglass layer; a second permeability-resistance film layer being located on the second surface of the core; a fiberglass layer being located on a second permeability-resistance film layer opposite the core layer; and a film layer being located over the fiberglass layer which is located on the second permeability-resistance film layer, and a second fiberglass layer being located on the film layer opposite the fiberglass layer.

Another illustrative embodiment provides a vehicle headliner which comprises a core layer, a permeability-resistance film layer, a woven fiber layer, and a film layer. The core layer has first and second surfaces, and comprises a binding resin, randomly-oriented sisal fibers, and randomly-oriented natural filler fibers. The permeability-resistance film layer is located on the first surface of the core. The woven fiber layer is located on the second surface of the core. The film layer is located over the woven fiber layer opposite the core layer.

In the above and other illustrative embodiments, the headliner panel may also provide: the woven fiber layer being a polyester woven fiber layer; the woven fiber layer being a polypropylene/cellulous woven fiber layer; a film layer being a polypropylene film; the polypropylene film layer being a 4 mil layer; the binding resin being a nylon film layer; and the nylon film layer being an about 4 mil layer.

Another illustrative embodiment provides a vehicle headliner which comprises a core layer, a first permeability-resistance film layer, a second permeability-resistance film layer, and a paper layer. The core layer has first and second surfaces, and comprises a binding resin, randomly-oriented sisal fibers, and randomly-oriented natural filler fibers. The first permeability-resistance film layer is located on the first surface of the core. The second permeability-resistance film layer is located on the second surface of the core. The paper layer is located over the second permeability-resistance film layer and opposite the core layer.

In the above and other illustrative embodiments, the headliner panel may also provide: the paper being a creped paper; a woven fiber layer located over the first permeability-resistance film layer opposite the core layer; the woven fiber layer being a polyester woven fiber layer; a woven fiber layer being a polypropylene/cellulous woven fiber layer; the first permeability-resistance film layer being a 4 mil nylon film layer.

Another illustrative embodiment provides a vehicle headliner which comprises a core layer, a first permeability-resistance film layer, a second permeability-resistance film layer, a first woven fiber layer, and a second woven fiber layer. The core layer has first and second surfaces, and comprises a binding resin, randomly-oriented sisal fibers, and randomly-oriented natural filler fibers. The first permeability-resistance film layer is located on the first surface of the core. The second permeability-resistance film layer is located on the second surface of the core. The first woven fiber layer is located on the first permeability-resistance film layer opposite the core. The second woven fiber layer is located on the second permeability-resistance film layer opposite the core.

Another illustrative embodiment provides a vehicle headliner which comprises a core layer, a first permeability-resistance film layer, a second permeability-resistance film layer, a first paper layer and a second paper layer. The core layer has first and second surfaces, and comprises a binding resin, randomly-oriented sisal fibers, and

randomly-oriented natural filler fibers. The first permeability-resistance film layer is located on the first surface of the core. The second permeability-resistance film layer is located on the second surface of the core. The first paper layer is located on the first permeability-resistance film layer opposite the core. The second paper layer is located on the second permeability-resistance film layer opposite the core.

Additional features and advantages of this disclosure will become apparent to those skilled in the art upon consideration of the following detailed description of illustrated embodiments exemplifying the best mode of carrying out such embodiments as presently perceived.

BRIEF DESCRIPTION OF DRAWINGS

The present disclosure will be described hereafter with reference to the attached drawings which are given as non-limiting examples only, in which:

Fig. 1 is a sectional view in panel form of a core material;

Fig. 2 is a sectional view in panel form of another illustrative embodiment of a laminated composite;

Fig. 3 is a sectional view in panel form of another illustrative embodiment of a laminated composite;

Fig. 4 is a sectional view in panel form of another illustrative embodiment of a laminated composite;

Fig. 5 is a sectional view in panel form of another illustrative embodiment of a laminated composite;

Fig. 6 is a sectional view in panel form of another illustrative embodiment of a laminated composite;

Fig. 7 is a sectional view in panel form of another illustrative embodiment of a laminated composite;

Fig. 8 is a sectional view in panel form of another illustrative embodiment of a laminated composite;

Fig. 9 is a sectional view in panel form of another illustrative embodiment of a laminated composite; and

Fig. 10 is a sectional view in panel form of another illustrative embodiment of a laminated composite.

Corresponding reference characters indicate corresponding parts throughout the several views. The exemplification set out herein illustrates several embodiments, and such exemplification is not to be construed as limiting the scope of this disclosure in any manner.

DETAILED DESCRIPTION OF THE DRAWINGS

A sectional view in panel form of a core layer 2 is shown in Fig. 1. The core layer 2 can serve as the base for any variety of laminated composite panels. One particular use of such panels is for the vehicle headliner application. In one illustrative embodiment, the core layer 2 comprises a formulation including about 30 percent polypropylene containing about 5 percent is maleic anhydride. The maleic anhydride is a coupling agent, and helps distribute the polypropylene and all the materials in the composition. The core layer 2 also comprises about 30 percent sisal fiber which provides stiffness as well as loft and standoff in high temperature environments. Also included is about 40 percent natural fibers which may be hemp, kenaf, or jute, for example. These natural fibers serve as a filler in combination with the sisal fiber. The natural fibers are non-directionally disbursed in the layer. The core layer 2 has an illustrative density of about 800 grams per meter square. It is appreciated, however, that the density of this composition may vary from about 400 grams per meter square to up above 1000 grams per meter square, for example. Other densities may work as well. The amounts of polypropylene, sisal fibers, and other natural fibers may too vary. In the case of

polypropylene, there can be about a 5 percent or more variation in range. This will depend on the particular application, keeping in mind any bonding requirements for that application. The variation of the sisal and other natural fibers may too vary by about 5 percent or more. Such variation could be greater, but cost factors between the sisal or like fibers, and the other natural fibers may be an influencing factor when deriving the actual formulation. As an illustrative range, the amount of polypropylene can vary from about 25 to about 35 weight percent, the sisal can vary from about 35 to about 45 weight percent, and the amount of natural fibers may vary from about 25 to about 35 weight percent.

The laminated compositions described herein are characterized as panels. These panels can be formed by any variety of lamination methods, including for example, the methods described in U.S. Patent Application, Serial No. 10/287,250, filed on November 4, 2002, entitled *Process, Composition and Coating of Laminate Material*, the disclosure of which has been incorporated herein by reference.

It is appreciated that panels in their pre-formed state are layered mats, which are, too, contemplated within the scope of this invention. With respect to the layers themselves, for the purpose of context, the film and layer thicknesses disclosed herein are done so at the pre-formed stage. For example, the 2, 3 or 4 mil film layers are identified as such even though their thicknesses may be reduced during manufacture into panels. These thicknesses are identified to teach the illustrative components used to create the resulting panel.

Another illustrative embodiment of this base material may comprise the formulation of about 30 percent polypropylene, about 30 percent sisal fiber, and about 40 percent other natural fibers. In addition, a core layer of any embodiment may comprise a top surface 3 and a bottom surface 5, wherein each receives a thin film layer 4, illustratively of polypropylene. This film layer 4 can provide adhesiveness to other composite layers, as well as provide water and air permeability resistance to the core

layer 2. This permeability resistance inhibits exposure of the natural fibers to air and water, for example, to prevent the natural fibers from creating odors or mildewing.

In another illustrative embodiment, core layer 2 may comprise about 10 percent by weight polypropylene fibers, illustratively comprising about 95 percent total weight generic polypropylene, and about 5 percent maleic anhydride, about 15 percent by weight kenaf or similar natural fibers, such as hemp, flax, or jute, about 45 percent by weight bi-component polyester fiber that is low melt (about 240 to 300 degrees F), and about 30 percent by weight single component polyester fiber that is high melt (440 degrees F). In an illustrative embodiment, the bi-component polyester may be a blend of about 50 percent high melt (440 degree F) polyester with about 50 percent low melt polyester (240 to 300 degrees F). This blend can assist in permitting control of the polypropylene movement during the heat phase of the laminating process. In another illustrative embodiment, the high melt polyester fibers in the layers described herein may comprise an outer sheath of low melt polyester (240 to 347 degrees F). It is appreciated that for these embodiments, other couplers may be substituted in place of maleic anhydride. In addition, the natural fibers can be pretreated with an anti-fungal/anti-micro bacterial agent. This is illustratively done prior to blending.

Another illustrative embodiment of core layer 2 may comprise about 30 percent by weight polypropylene fibers which itself illustratively comprises about 95 percent generic polypropylene and about 5 percent maleic anhydride. The core may also comprise about 40 percent natural fiber, including kenaf, hemp, flax, or jute, and about 30 percent by weight bi-component polyester. The natural fibers can be pretreated with anti-fungal/anti-micro bacterial agent. Again, the bi-component polyester may be a 50/50 high melt/low melt blend.

Another illustrative embodiment of a laminated panel 6 is shown in Fig. 2. Laminated panel 6 includes core layer 2 with 2 mil (0.002 inch) thick polypropylene film layers 4 bounding the top and bottom surfaces 3 and 5, respectively, of core layer 2.

Formed on one of the polypropylene layers 4, opposite the core layer 2, is a fiberglass layer 8. The fiberglass layer is, illustratively, a 40 grams per meter square chopped strand glass. Bounding the surface of fiberglass layer 8, opposite the 2 mil polypropylene layer 4, is another polypropylene layer 10. This layer 10 is illustratively a 1 ounce per yard square polypropylene layer. Another 40 gram fiberglass layer 8 is located over the polypropylene layer 10. An illustrative example of such a system is an Owens-Corning® brand fiberglass product. This glass layer is one 40 gram layer of chopped glass fiber (e glass), one layer of polypropylene spun bond and one additional layer of 40 gram chopped glass. The combined layers are then hot calendared causing consolidation of the three layers into one. It is appreciated that the spun bond polypropylene layer can be substituted with a 2 mil polypropylene film layer. It is appreciated that the specific densities and material types recited with respect to this embodiment are illustrative.

A sectional view of another illustrative embodiment of a laminated composite panel 12 is shown in Fig. 3. The illustrative panel 12 is similar to the illustrative panel 6 shown in Fig. 2, with the addition of the glass layers 8 and the polypropylene layer 10 located therebetween, and positioned on the underside of core layer 2, adjacent film layer 4. The embodiments shown in Figs. 2 and 3 provide high strength composite panels with the temperature stability of the core layer 2 to prevent substantial dimensional fluctuations as a result of high temperature environments. Again, the film layers 4 that sandwich core layer 2 assist in preventing water or air from entering the surfaces of the core layer 2 and affecting the natural fibers therein.

Fig. 4 is another illustrative embodiment of a laminated composite panel 14 which comprises the core layer 2 with a 2 mil polypropylene film layer 4 on top surface 3, and a 50 gram per meter squared polyester weave layer 16 on the bottom surface 5. The particular density of this layer is illustrative and can be varied, depending on the application, for example. A 4 mil polypropylene film layer 18 is located on the lower surface of polyester weave layer 16, opposite core layer 2. This polypropylene

layer 18 serves to seal the polyester weave layer 16 as well as the core layer 2. This illustrative embodiment has shown to be quite rigid under environmental testing conditions. For example, in one such test, the laminated composite panel 14 was subjected to a temperature of 95 degrees C. After the panel was allowed to cool for one hour to an ambient temperature of 23 degrees C, a cantilever test was conducted revealing a sag of about 1.27 millimeters. This is within a target deflection range of about 10 millimeters for a headliner application. Other panel or headliner applications may not require such a limited deflection range. It is appreciated that the polyester weave layer 16 can be substituted with a cellulous fiber and polypropylene weave layer. In an illustrative embodiment of the cellulous fiber weave, the density of the layer may be about 67 grams per meter squared.

Another illustrative embodiment of a laminated panel 20 is shown in Fig. 5. This embodiment includes core layer 2 bounded on both the top and bottom surfaces 3 and 5, respectively, by a polypropylene film layer 4. Laminated on the lower surface of the polypropylene film layer 4, opposite surface 5, is a multi-directional creped paper material 22 having an illustrative density of about 130 grams per meter square. A cantilever test, like that described with respect to panel 14 in Fig. 4, showed that after cooling for about one hour, a deflection of only about 1.27 millimeters resulted. It is appreciated that, in this embodiment, the densities of the paper, as well as the core, may vary depending on the desired application.

A sectional view of another illustrative embodiment of a laminated panel 24 is shown in Fig. 6. Panel 24 comprises a core layer 2 bounded on the upper and lower surfaces 3 and 5, respectively, by a 2 mil polypropylene film layer 4. The surfaces of film layer 4, opposite core layer 2, receive a 50 gram polyester weave layer 16. It is appreciated that the specific density of the polyester weave layer 16 may vary depending on the desired application. Conducting an environmental cantilever test on this embodiment produced a deflection of about 15.69 millimeters which is above the desired

range of maximum deflection of 10 millimeters for a headliner application, but would be within tolerance for other uses that may not require such high temperature resistance.

A sectional view of another illustrative embodiment of a composite panel 26 is shown in Fig. 7. Panel 26 comprises a core layer 2 bounded on both the upper and lower surfaces 3 and 5, respectively, by 2 mil polypropylene film layers 4, which are themselves bounded on their outer surfaces by 130 gram creped paper 22. Similar to the previous embodiment shown in Fig. 6, panel 26 demonstrated a deflection of about 12.7 millimeters in an environmental cantilever test. This is above the desired maximum deflection of 10 millimeters for headliner applications. Panel 26, similar to panel 24, however, may be used in applications where the temperature resistance is not as critical.

A sectional view of another illustrative embodiment of a laminated composite panel 28 is shown in Fig. 8. Panel 28 comprises a core layer bounded on upper and lower surfaces 3 and 5, respectively, by 2 mil polypropylene film layers 4. The top surface of film layer 4, opposite surface 3 of core layer 2, receives a 50 gram polyester weave layer 16. The lowermost surface of film layer 4, opposite surface 5 of core layer 2, receives a 130 gram creped paper layer 22. Again, similar to previous embodiments, the specific densities of layers 16 and 22, can be varied depending on the desired application. In addition, an environmental cantilever test of panel 28 has shown a deflection of about 3.81 millimeters which is within the range of the 10 millimeters for the headliner application.

A sectional view of another illustrative embodiment of a laminated composite panel 30 is shown in Fig. 9. Panel 30 comprises a core layer 2 with its upper surface 3 bounded by a layer of about 3 mil nylon film 32. On the lower surface 5 of core layer 2 is a 50 gram polyester weave layer 16. In this particular embodiment, the density of core layer 2 is about 1000 grams per meter square. It is appreciated, however, that the densities can be varied for any particular application. The lowermost layer applied to the surface of polyester weave layer 16, opposite surface 5 of core layer 2, is a

4 mil polypropylene film layer 34. It is appreciated that, in this embodiment, the polypropylene film layer 34 serves as the lower barrier to resist moisture and air from contacting both weave layer 16 and core layer 2, whereas the upper nylon film layer 32 serves the same purpose for the upper surface 3 of core layer 2. In addition, when panel 30 is subjected to an environmental cantilever test, it was shown to deflect about 10.16 millimeters, approximately the maximum for a particular headliner application.

A sectional view of another illustrative embodiment of a laminated composite panel 36 is shown in Fig. 10. The illustrative panel 36 comprises a core layer 2, illustratively having about a 1000 grams per meter square density with an about 3 mil nylon film 32 bounding the core layer's 2 upper surface 3, and a 2 mil polypropylene film layer 4 bounding the core layer's 2 lower surface 5. Bounding the upper surface of the nylon film's 32 upper surface, opposite surface 5 of core layer 2, is a 50 gram polyester weave 16. The lowermost surface of film layer 4, opposite core layer 2, is a 130 grams per millimeter square creped paper layer 22. An environmental cantilever test conducted on panel 36 showed a deflection of about 10.16 millimeters. It is appreciated that the film thickness of this embodiment, as well as the other embodiments, are approximations. The thicknesses may vary depending on the composition of the film, as well as its permeability resistance.

Although the present disclosure has been described with reference to particular means, materials and embodiments, from the foregoing description, one skilled in the art can easily ascertain the essential characteristics thereof and various changes and modifications may be made to adapt the various uses and characteristics without departing from the spirit and scope of the present invention as set forth in the following claims.